

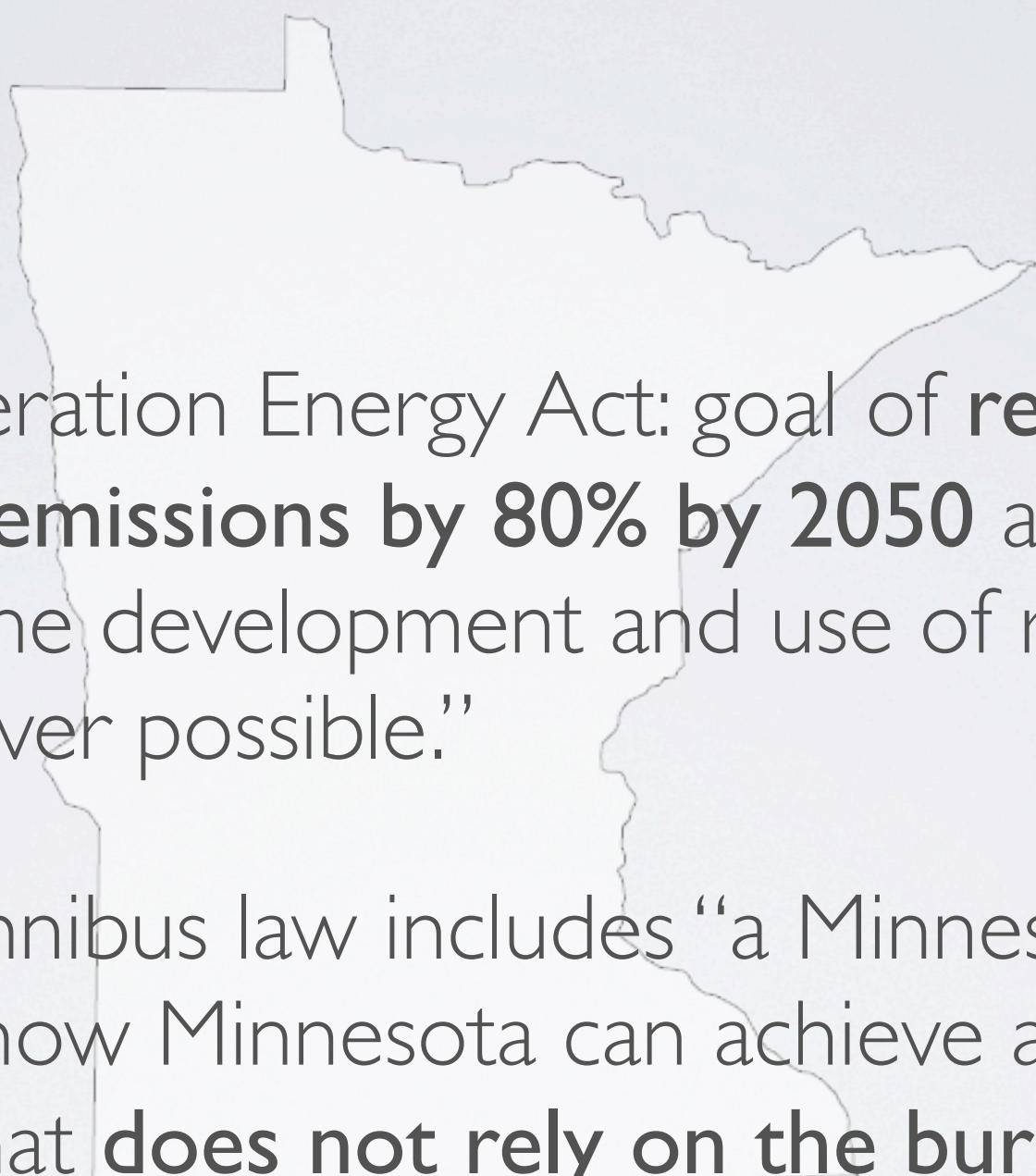
WHAT'S SOLAR WORTH?

Bringing Minnesota's value(s) to solar

John Farrell, Director of Democratic Energy

Presentation to Minnesota Value of Solar Stakeholder Workshop - Oct. 1, 2013

BACKGROUND

- 
- 2007 Next Generation Energy Act: goal of **reducing greenhouse gas emissions by 80% by 2050** and that state should pursue “the development and use of renewable energy resources wherever possible.”
 - 2013 Energy Omnibus law includes “a Minnesota energy future study on how Minnesota can achieve a sustainable energy system that **does not rely on the burning of fossil fuels.**”

ENERGY

Other Possible Components May Include

Value Component	Basis	Legislative Guidance
Voltage Control	Cost to regulate distribution (future inverter designs)	
Market Price Reduction	Cost of wholesale power reduced according to reduction in demand.	
Disaster recovery	Cost to restore local economy (requires energy storage and islanding inverters)	

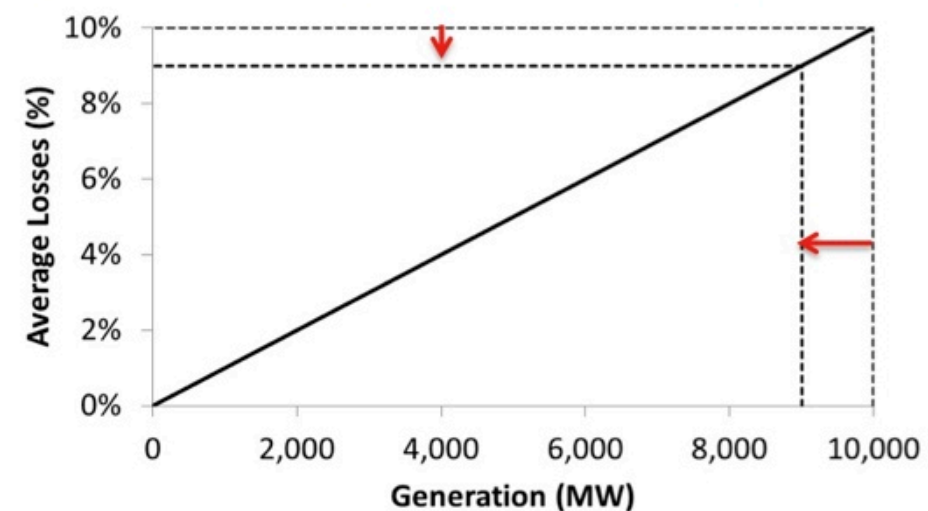


LOSSES

- But, high load means higher losses

Generation Relates Linearly to Avg. Losses

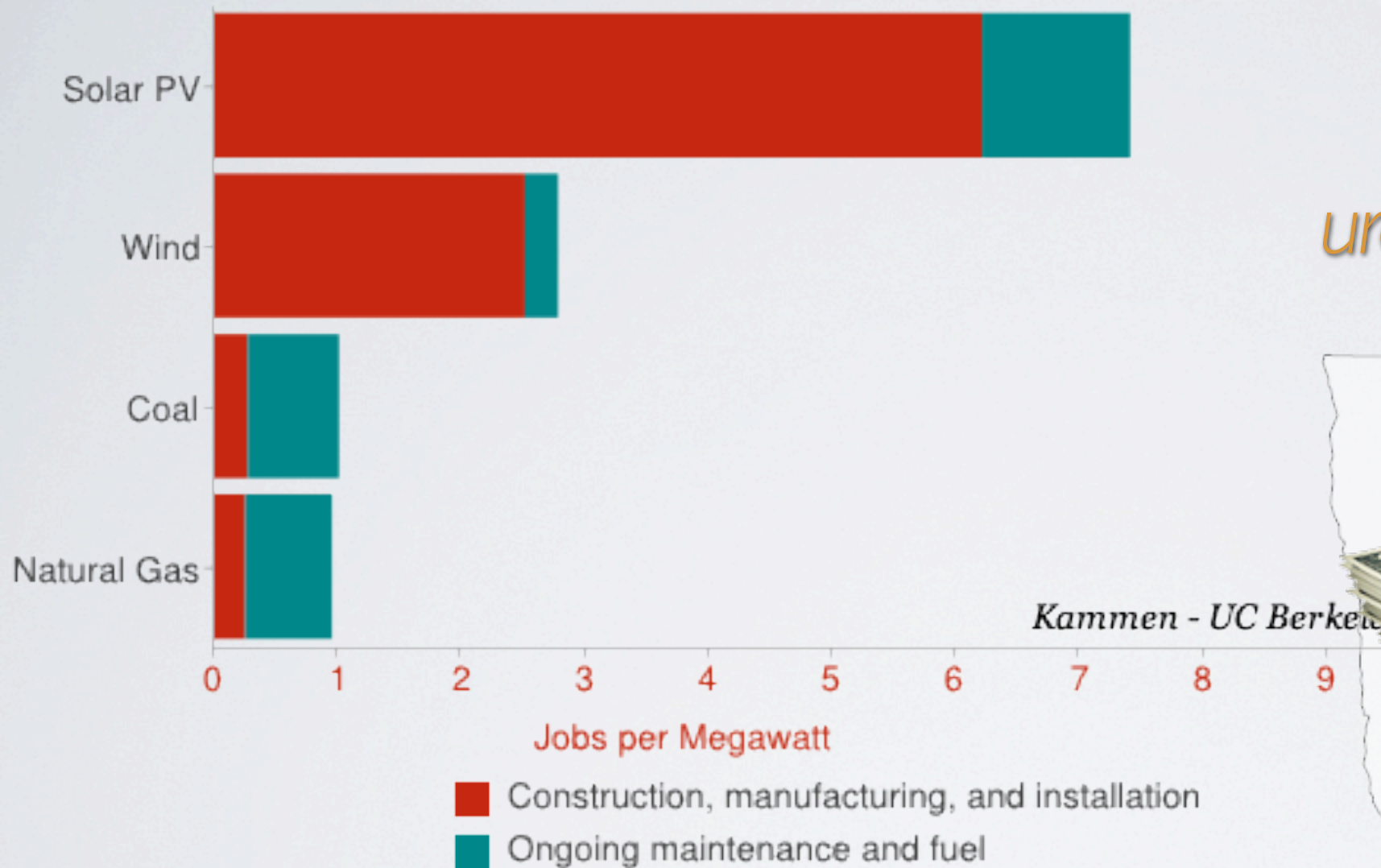
Example of marginal loss savings calculation for a given hour



	Without PV	With PV	Change
Generation	10,000 MW	9,000 MW	1,000 MW
Avg. Losses	10%	9%	
Losses	1,000 MW	810 MW	190 MW
Loss Savings			19%

You can't just add 10% to PV production!

ECONOMIC DEVELOPMENT



*MN has no coal,
uranium, or natural gas*



ENVIRONMENTAL

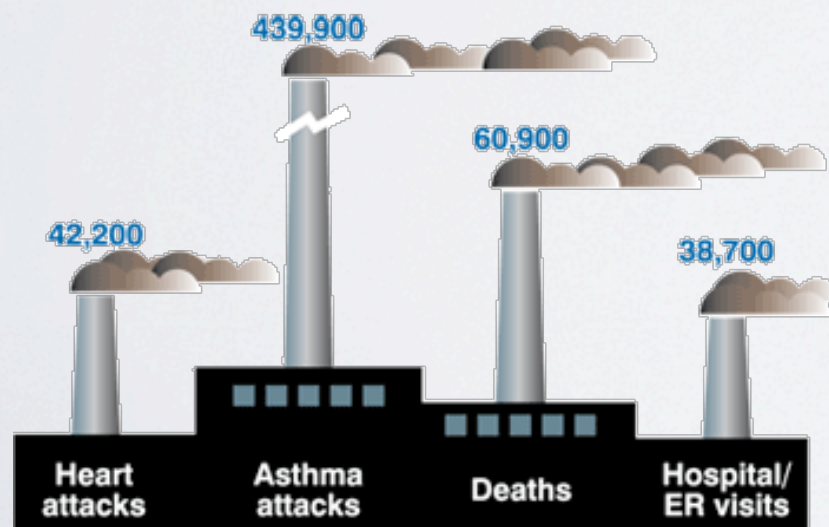
New Regs.

- Cross-State Air Pollution Rule (CSAPR)
- Carbon Pollution Standards for the Power Sector



The Price of Coal

Estimated number of Americans affected each year



Source: EDF

Social Cost of Carbon

\$150

\$120

\$90

\$60

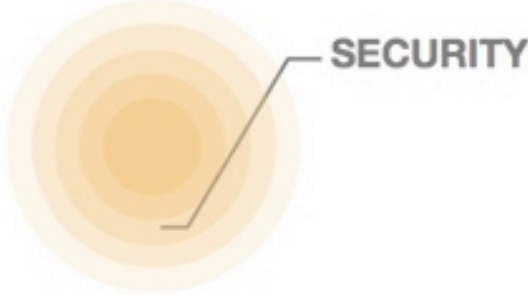
\$30

\$0



RELIABILITY / RESILIENCE

SECURITY: RELIABILITY AND RESILIENCY



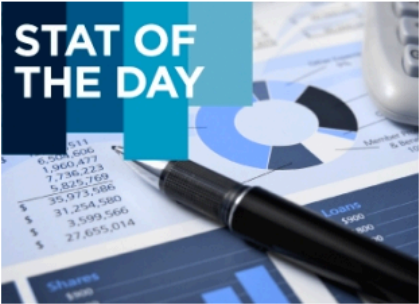
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63

1

39

Smart Grid Saves EPB Chattanooga \$1.4M in One Storm



A smart grid and switches keep the lights on in Tennessee.

Katherine Tweed: October 17, 2012

In July, we reported on the first real test of [EPB Chattanooga's smart grid investment](#) that occurred when a powerful windstorm roared through the city in Tennessee.

The utility, which serves 170,000 customers, found that it cut its power outages by at least half, according to Jim Glass, manager of smart grid development at EPB Chattanooga.

At the time, Glass said it was difficult to put a monetary figure on the savings. But new data has done just that. The utility has been installing 1,200 [S&C IntelliRupter automated switches](#) on the distribution grid since early 2011. The utility also boasts one of the [fastest internet pipelines in the world](#) and a full [set of smart meters](#).

APPROACH & KEY CHOICES

What is the value of increased reliability and resilience?

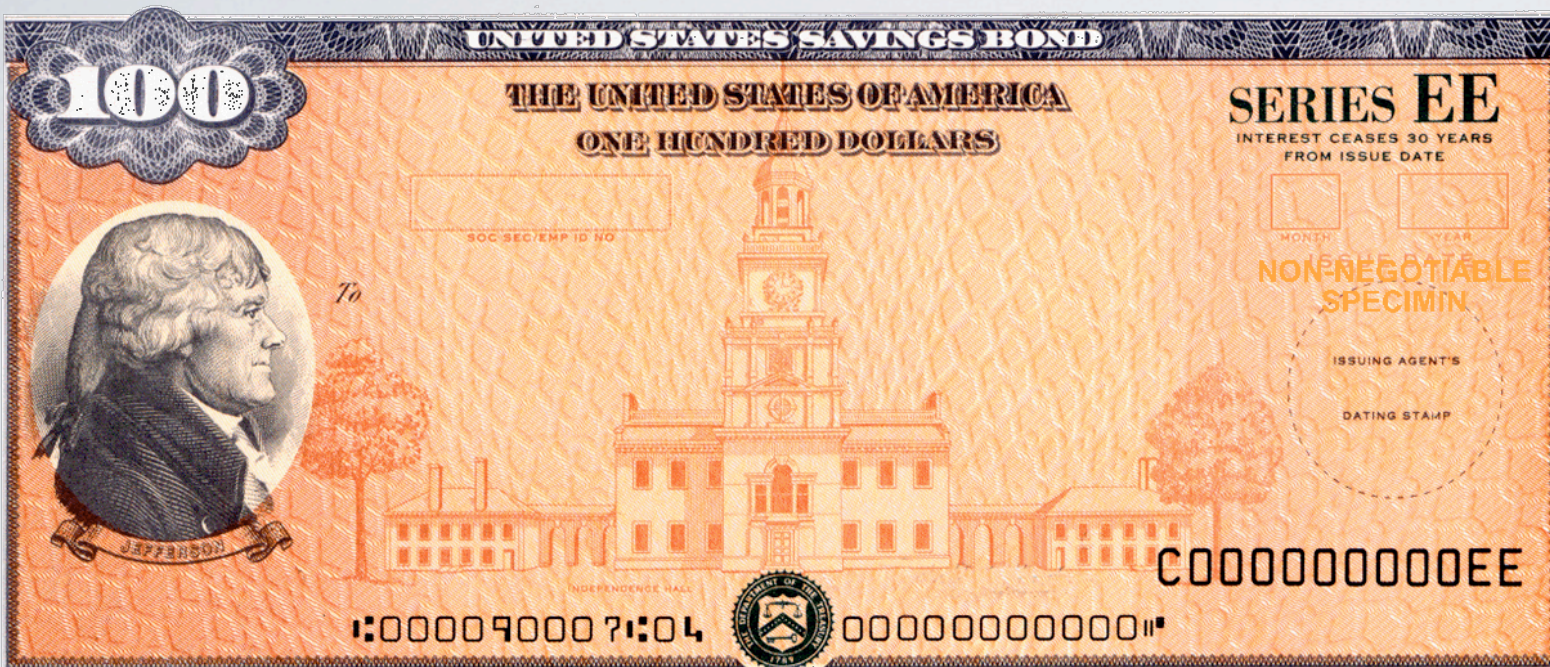
- Economic value of reduced blackouts

Sector	Min	Max
Residential	0.028	0.41
Commercial	11.77	14.40
Industrial	0.4	1.99

Source: The National Research Council, 2010

How much can DPV increase reliability

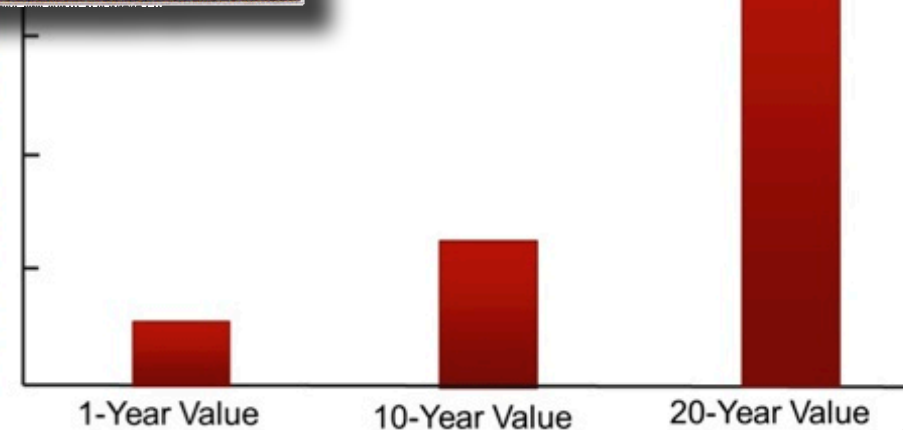
RATE / TIMEFRAME



service life (20 to 30 years, degradation included)

- Levelized value converts present value to fixed contract term (20 years minimum as required by legislation).
- Assume that valuation period is the same as contract period to avoid confusion.
- If PV life extends beyond contract term, future credit can be determined then.

Levelized Value

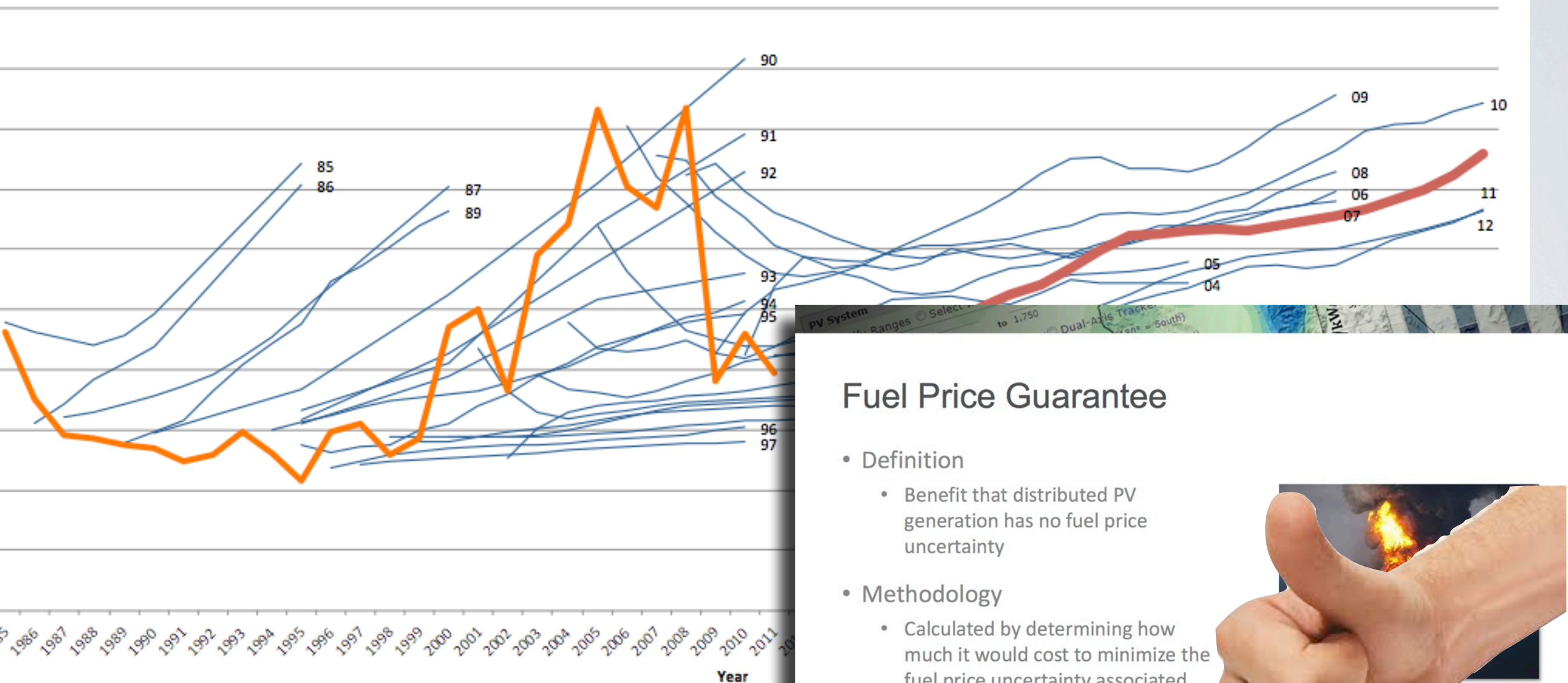


Recommendation: Assume

- 25 year life,
- 25 year value,
- 25 year levelization

HEDGING

EIA Projections v. Actual U.S. Average Wellhead Natural Gas Prices



Fuel Price Guarantee

- Definition
 - Benefit that distributed PV generation has no fuel price uncertainty
- Methodology
 - Calculated by determining how much it would cost to minimize the fuel price uncertainty associated with natural gas generation



TRANSPARENCY

- Utility inputs, too!

VOS Methodology Objectives

- Accurately account for all relevant value streams.
- Simplify input data set, where possible.
- Simplify methodology, where warranted.
- Easy to modify, if necessary, in future years.
- Provide transparency
 - Will define a “**VOS Intermediate Data Standard**” explicitly identifying all key input assumptions. (e.g., solar-weighted heat rate, distribution cost escalation rate, cost of capacity). This will provide all stakeholders with comparable data across utilities and other studies outside Minnesota.
 - With the same intermediate dataset, all stakeholders will be able to derive the same levelized \$/kWh value.
 - Will include an **example calculation** showing annual savings calculation details. This will be used to further ensure that users of the methodology are performing calculations correctly.

